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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 21 October 2002 with an application for Letters Patent number 522158 made by Rocktec Limited.

Dated 5 November 2003.

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PATENTS FORM NO. 4

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James & Wells ref: 121250/31

PATENTS ACT 1953
PROVISIONAL SPECIFICATION**A LOCKING MECHANISM**

We, Rocktec Limited, a New Zealand company of Mangawhero Road,
 Matamata, New Zealand
do hereby declare this invention to be described in the following statement:

James & Wells ref: 121250/31

A LOCKING MECHANISM

TECHNICAL FIELD

This invention relates to a lock for application to a moveable shaft.

In particular, it relates to a lock for securing a shaft, capable of substantially vertical
5 movement, at any desired height along its axis.

BACKGROUND ART

Drop hammer devices are used to break up concrete, building material, rock, solid
ground or the like. By breaking up concrete or building material into smaller pieces,
the pieces are reduced to manageable sizes, ready to be removed by excavators and
10 loaders or the like. By breaking up ground, access is allowed to the material or soil
below. This is particularly applicable when working with frozen ground such as
permafrost.

Other types of machinery used to break up concrete or the like include hydraulic
hammers and Pulverisers. Hydraulic hammers are limited to functioning only for
15 their intended purpose, which is to break material into smaller pieces. A number of
hydraulic hammers have been broken by operators attempting to use them as a rake or
sweep to move broken material away from the breaking zone. Pulverisers are used to
grip onto walls or the like and squeeze them, thus crushing the material between. A
disadvantage of a nipper is that it has only one intended purpose and therefore other
20 machinery is required if the job has multiple requirements.

If any attempt is made to rake with a drop hammer device, the hammer itself will
retract back into the casing at any sign of downward or sideways pressure. The
hammer inside the casing is not secured directly to any part of the casing, it is instead
held in position by the sides of the casing, but they act only as a guide. Therefore,

any substantially downward or sideways pressure will only push the hammer back into the casing, as the hammer is not secured. Therefore, a drop hammer device cannot usually be used for raking either.

5 It is common practice for a number of machines to work in conjunction with each other at a breaking site. A drop hammer device mounted on an appropriate piece of machinery will break up the area required. An excavator or loader will then move in to remove the broken material and the drop hammer device will then be moved to the new position for breaking and the cycle continues.

10 It is also common practice for a single machine to use two attachments, particularly on small jobs. The machine will use one attachment to undertake part of a job, switch between a bucket and a hammer and then continue the job. This type of operation has a number of disadvantages in that the operator must disconnect hoses and reconnect them to the new attachment. Each time the hoses are disconnected, hydraulic fluid will leak out, raising environmental concerns over site contamination.
15 Additionally, the time taken to undertake such a changeover means increased downtime and a higher skill level for the operator.

It can be expensive to use multiple pieces of machinery for demolition and cleanup. These machines are charged out at an hourly rate and either the drop hammer device or removal machinery will sit idle while the other completes its job.

20 It would be an advantage to have a piece of machinery that could both break material and move it away from the breaking zone so that other machines could work alongside without requiring the drop hammer machinery to halt operation.

Drop hammer devices currently in use cannot fulfil this role in their present configuration as a hammer is configured to move in a substantially vertical direction
25 from a raised to a lowered position. They are not designed to be used in a raking

motion as they are not secured to the hammer housing.

It should be appreciated that while drop hammer devices are not designed to be used in a raking motion, they can be operated at angles substantially away from the vertical plane. This freedom of movement away from the vertical allows drop hammer
5 devices to be used to break uneven portions of concrete, and low lying walls or the like and extends the number of places a drop hammer device can be utilised.

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert,
10 and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

15 It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or
20 elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from
25 the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a method of securing a shaft at any point along its substantially vertical axis of movement, including a locking device,

5 wherein the locking device has at least one face that is moveable with respect to the shaft, the method characterised by the step of

- a) moving the locking device into a position wherein at least one face of the locking device mates against at least one point on the shaft so as to secure the shaft at any point along its substantially vertical axis of movement.

10 The term 'shaft' in accordance with the present invention should be understood to mean an elongated block or pole that can be moved along a substantially vertical axis. It should be appreciated that the axis can be angled up to approximately 89° either side of vertical as desired. However, this angling of the shaft can only be achieved when the shaft and its housing are moved as a single unit. The shaft itself has some
15 freedom of movement within its housing, but only sufficient to allow for normal activity, as known to someone skilled in the art.

) In preferred embodiments the shaft is an elongated block that is formed into a hammer, the hammer being an elongated piece of heavy material designed to be pounded into an area to result in failure of the material underneath, be it concrete,
20 building material, rock, ground, or the like. However, these are listed by way of example only and should not be seen to be limiting.

For ease of reference, the shaft shall now be referred to as a hammer throughout the specification however this should not be seen to be limiting.

It should be appreciated that the hammer can be enclosed within a housing, the

housing including a mechanism configured to lift the hammer to a raised position. Once the hammer is in the raised position it can be released and due to the weight of the hammer, gravity will accelerate the hammer into the area beneath the hammer, imparting a large impact force and breaking or weakening whatever is situated
5 beneath the impact zone.

It should further be appreciated that the hammer could be in the shape of a cylinder or an elongated box with multiple faces, or variation thereof as these are listed by way of example only and should not be seen to be limiting.

10 In preferred embodiments the hammer is an elongated vertical column with multiple faces.

It should be appreciated that the hammer does not normally include any internal attaching means to secure the hammer to the hammer housing, instead the hammer is held in place by the hammer housing, but it is not usually physically attached to it. Upon activation, the raising of the hammer can be undertaken by any number of
15 mechanisms that impart lift. The mechanisms used to lift the hammer into position are known to someone skilled in the art and can include a cable attached to the upper end of the hammer or a chain and dog arrangement that engages a protrusion that extends from the hammer itself, however these are listed by way of example only.

)
The term 'dog' in accordance with the present invention should be understood to
20 mean a catch physically attached to the chain that protrudes outwards, and will engage any protrusion extending from the drop hammer. The term 'dog' is known to someone skilled in the art, but should not be seen to be limiting.

The term 'protrusion' in accordance with the present invention should be understood to mean at least one extension of a portion of the drop hammer out to the side of the
25 drop hammer so it is available to be engaged by the dog.

Once engaged, the upward movement of the chain will lift the dog and the drop hammer along with it.

It should be appreciated that there can be more than one protrusion which can be positioned on any vertical side of the drop hammer.

- 5 In preferred embodiments, the mechanism used to lift the hammer into its peak vertical position is the chain and dog arrangement. The chain rotates around at least two sprockets positioned lengthwise to the drop hammer. The chain has at least one dog attached to it that engages the protrusion, or protrusions positioned on the hammer. As the chain is rotated, the hammer will lift as the dog attached to the chain rises. As the hammer reaches its maximum vertical height, the dog attached to the chain rotates around the sprocket and the hammer is released as the protrusion is positioned to the side of the sprocket.
- 10

It should be appreciated that any locking device could be positioned to abut against any point anywhere on the hammer.

- 15 It should also be appreciated that the vertically rotating chain could either be parallel with or perpendicular to the hammer. Accordingly, any locking device could be positioned between the rotating chain, as the chain would, in preferred embodiments, be oriented parallel to the hammer, rather than perpendicular to it in order to reduce the overall size of the hammer housing and therefore the overall weight of the unit as a whole.
- 20

The term 'locking device' in accordance with the present invention should be understood to mean a friction-based lock such as a cam, magnet or any locking means that utilises the onset of friction between two faces as they mate together to lock an item into a position, although these are listed by way of example only and should not be seen to be limiting.

25

By using a friction based locking device, the likelihood of damage to the locking device or the mechanism around it is reduced. If a pin based locking device where a pin enters a recess were used, the likelihood of the pin shearing over time due to impact wear would be higher. If the locking device was activated while the hammer was moving, any pin based locking device would more than likely be sheared off due to the downward force of the hammer. The use of a friction based locking device would mean that even if the lock were activated while the hammer was falling, the friction created by the two faces meeting would only serve to slow the hammer down and lock it into place, not shear the cam off it's rotational axis, although it is not envisaged that the lock would be engaged while the hammer is in vertical fall.

It is an advantage of a friction-based lock that there is a reduced likelihood of damage to the lock due to shearing or the like.

The term 'cam' is a term known to someone skilled in the art and refers to a substantially flat projection on a rotating part in machinery.

In preferred embodiments the locking means is a cam configured so that on activation the cam will rotate and the substantially flat face will turn and meet, or mate with the face of the hammer at whatever position the hammer is in.

Cams are versatile and will allow slip between the two 'mating' faces should the force applied to the hammer overcome the strength of the lock. This slip therefore reduces the likelihood of destruction of the locking means in unusual circumstances.

It should also be appreciated that cams can be self tightening. As the rotation of the cam is in a clockwise direction to bring the substantially flat face up against the hammer, any upward pressure of the hammer against the cam face will only serve to tighten the lock.

It is also an advantage of this type of locking means that the hammer can be secured

at any height. The length of protrusion of the hammer out of the hammer housing can therefore be varied as desired by the excavator operator.

This is a distinct advantage over any locking mechanism that uses a pin and recess arrangement. Either recesses must be positioned at multiple points along the
5 hammer, or there limited locking positions available. A friction based locking means can be activated at any point along the length of the hammer.

If the operator is using the hammer to break material, the hammer itself can be secured with any desired portion of the hammer extending out of the hammer housing. If the broken material is of a thicker nature, a larger portion of the hammer
10 can be set to protrude from the hammer housing. The material can then be raked or moved in the horizontal motion to one side so that other machines can work alongside the hammer mechanism to remove the material.

This has a distinct advantage over the prior art as it allows both hammer and removal machines to work concurrently rather than consecutively.. This has key advantages in
15 reducing the costs to undertake a job as the time to complete the job is faster.

Another advantage of the present invention is that the addition of a locking mechanism allows a single machine to do the job of two machines. Both hammering and raking can be undertaken by the same machine, saving time and money and potentially increasing the safety of a worksite due to less heavy machinery working in
20 a demolition site.

The ability to lock the hammer at any desired protrusion length is a further advantage in that the hammer length can be set to provide the operator with maximum visibility, therefore increasing operator comfort. The operator can also lock the hammer at any length, making the job effectively easier as there is less likelihood of damaging the
25 hammer through incorrect usage.

The ability to lock the hammer in any desired position along its vertical axis is a distinct advantage over any standard drop hammer device as the drop hammer is usually not attached to any hammer housing. As such, any pressure applied to the hammer will push it back up into the housing, making raking or sweeping of material impossible.

In other embodiments, the locking means could be a mating face with a negative gradient that abuts a specially configured mating face on the hammer with a positive gradient. When the mating face of the locking means is rotated to abut the hammer the hammer is locked in place.

10 The direction of the slope of each mating face is important as if the hammer receives a knock, the locking means will tighten rather than release.

According to another aspect of the present invention there is provided a locking device for reversibly locking a hammer at any point along its substantially vertical axis of movement

15 wherein the locking means has a mating face, that once activated, will position itself against the mating face of the hammer to secure it in position.

The term 'mating face' in accordance with the present invention should be understood to mean the substantially flat surface of one portion of the locking means as one half of the pair of mating faces, and the substantially flat surface of the vertical portion of the hammer.

20 While the locking means utilises friction in order to secure the hammer in place, the pressure provided to the mating faces to increase friction to initiate locking can be undertaken by a number of means.

In preferred embodiments, a cam is used as the locking means. The rotation of the

cam can be controlled by a hydraulic system.

The advantage of controlling the movement of the cam by hydraulics is that the hydraulics controlling the main housing can be tapped into to provide the further controlling means for the cam, therefore simplifying the addition of the locking
5 device to drop hammer devices already in use.

Another advantage of using hydraulics to control the cam is that the abutment of the mating faces is by pressure, the preferred outcome of hydraulic application.

It is envisaged that when the hammer is being used as originally intended; moving through a substantially vertical trajectory, the locking means will remain in the
10 unlocked position with the hydraulic controls in the off position. This will keep the two mating faces separate from each other and allow the hammer to fulfil its job.

It should be appreciated that it would be virtually impossible to lock the hammer in place while the it is operating as the hydraulic controls that activate the cam lock also activate the hammer itself. For one to work the other must be non-operational,
15 therefore making it physically impossible to work the lift and lock mechanism at the same time, which reduces the likelihood of unintentional damage to the machine.

It should however be appreciated that the hammer could be used at any angle away from the vertical, provided there is sufficient force provided by gravity or some other propulsion means.

20 When the control means in the cab of the carrier is activated, therefore engaging either a forward or sideways motion to the carrier and therefore the hammer itself, the hydraulic mechanism will be activated, the cam rotated and the hammer locked in place.

Accordingly, whatever position the hammer is in with respect to the hammer housing

at the time of activation of the cam, the hammer will be locked into that position.

It should therefore be appreciated that the height of the hammer can be easily varied by pausing the vertical lift of the hammer housing and activating the cam.

5 It should also be appreciated that the hammer could be rested on the ground and the hammer housing moved with respect to it to push the hammer into the housing to the desired distance.

10 It is an advantage of the present invention that the drop hammer device itself has, by the addition of a lock, become a complete tool for both the breaking and moving of material. The end of the hammer is not only used for its impact, but also to rake material away from the work zone.

15 It is the inventor's opinion that a locking means designed to secure a hammer in a desired position to allow a raking or pushing movement has never been undertaken before. The combination of the locking means with the hammer means that a job undertaken by a drop hammer device can be completed in shorter time because not only can broken material be dragged to one side, but a larger partially broken piece could also be positioned for a second impact, making the job of the assisting machinery easier.

BRIEF DESCRIPTION OF DRAWINGS

20 Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic illustration of a preferred embodiment of the present invention; and

Figure 2 is a diagrammatic representation of a preferred embodiment of the

present invention showing a cam as the locking device, and

Figure 3 is a close-up of the diagrammatic representation of one preferred embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

5 With reference to figure 1, there is illustrated a hammer (1), encased within a hammer housing (2) which is attached to a hydraulic excavator generally indicated by arrow 3.

Also illustrated in figure 1 is the hydraulic activation means (4) for use to engage the locking device (not shown in this figure).

10 With respect to figure 2 there is shown a close-up of a drop hammer device generally indicated by arrow 5. The drop hammer device 5 consists of a hammer (6), a raising mechanism generally indicated by arrow 7 in the form of a rotating chain (8), two end sprockets (9 a and b), a protrusion (10), a cam lock (11), a hydraulic activating means (12) and a hammer housing (2).

15 With respect to figure 3, there is shown a close-up of the cam lock (11) and the hydraulic activating means (12). Also shown are the rotating chain lower sprocket (9b), the protrusion (10), the hammer (6) and the hammer housing (2).

When the hammer (6) is operating, the rotating chain (8) containing at least one dog (not shown) rotates.

20 The dog abuts the protrusion (10) situated on the side of the hammer perpendicular to the rotating chain (8).

As the chain (8) rotates, the dog rises, lifting the protrusion (10) which in turn raises the hammer (6).

When the protrusion (10) rises to a point level with the upper sprocket (9a), the dog

rotates over the top of the upper sprocket (9a) and releases the protrusion (10), allowing the hammer to fall.

When the hammer (6) has completed its fall, the dog will rotate around the chain (8) and then abut the protrusion (10) and repeat the vertical lift.

- 5 In order to lock the hammer (6) in any position along it's trajectory, the cam (11) is rotated around its axis (13) by means of an actuator (14) which is controlled by the hydraulic activating means (12).

The actuator (14) is made up of two parts that pivot at the joint (15). The forward motion of the actuator (14) combined with the pivoting of the actuator at it's joint
10 (15) allow the cam (11) to rotate to engage the hammer (1). This means that the hammer can be engaged at any point along its trajectory.

Once the hammer (6) is locked in a position by the cam (11) it can then be used at any angle, rather than just vertical, to rake material or position material for further impacting.

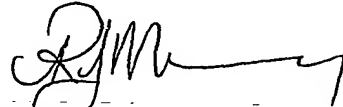
- 15 The operator can initiate the engagement of the cam (11) by activation of the hydraulic activating means (12) from inside the hydraulic excavator.

It should also be appreciated that the initiating of the cam (11) will either disengage or halt the raising mechanism (7), or push the hammer (6) away from the raising mechanism (7) and up against the far side of the hammer housing (12) so that the
20 catch mechanism cannot engage the protrusion (10) and raise the hammer (1).

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

ROCKTEC LIMITED

by its Attorneys



JAMES & WELLS

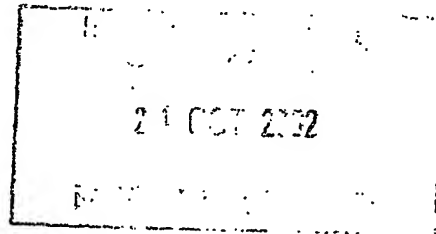


FIGURE 1

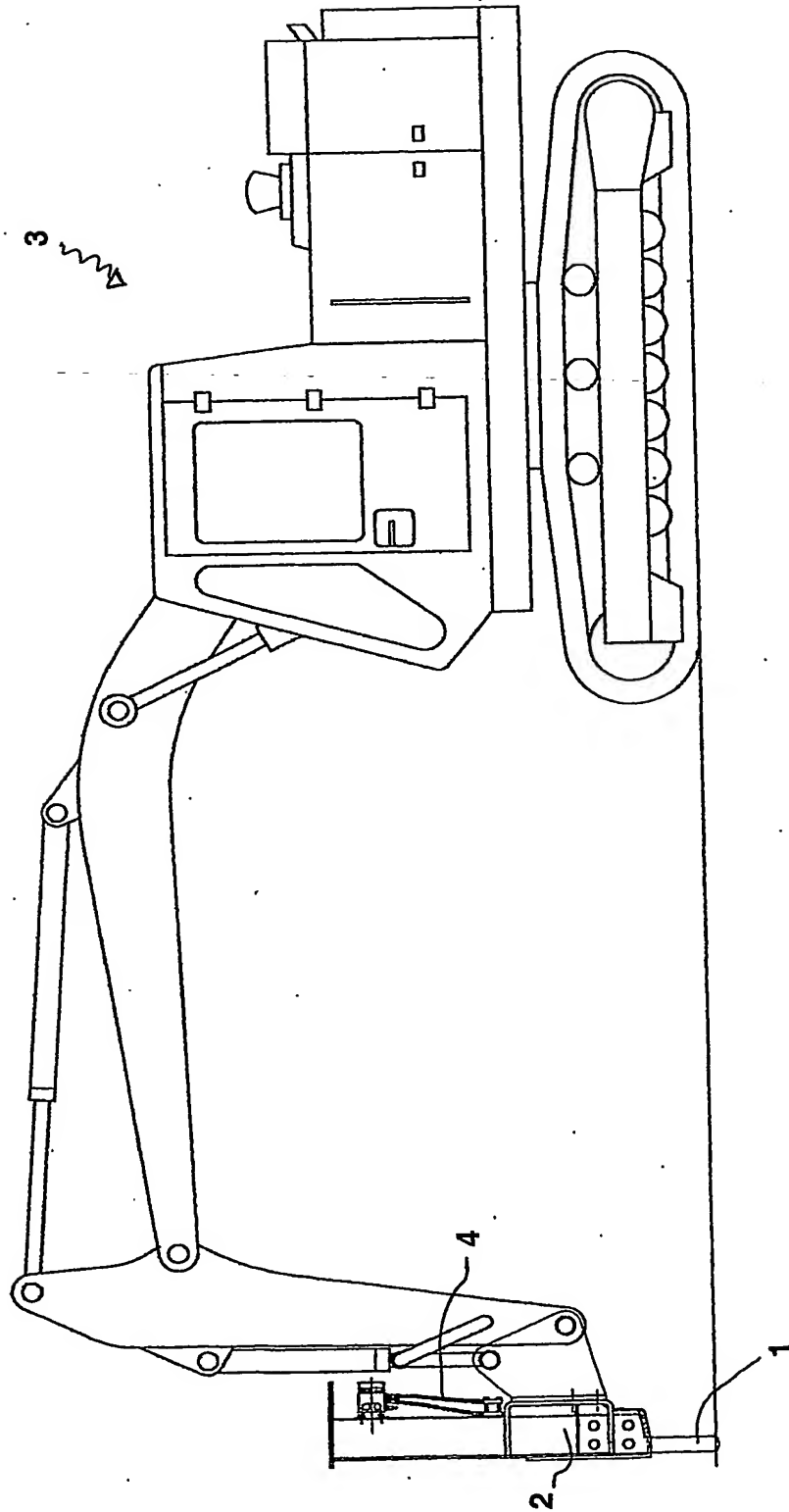


FIGURE 2

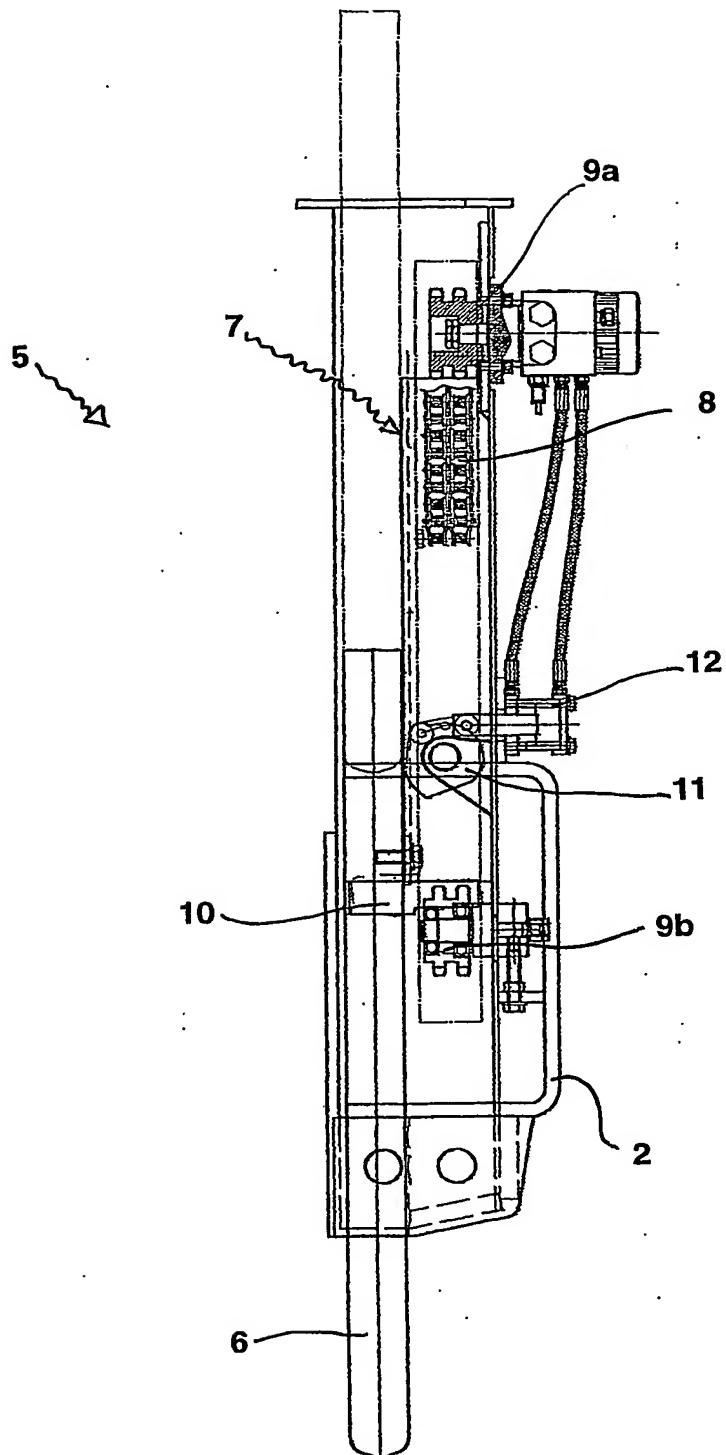
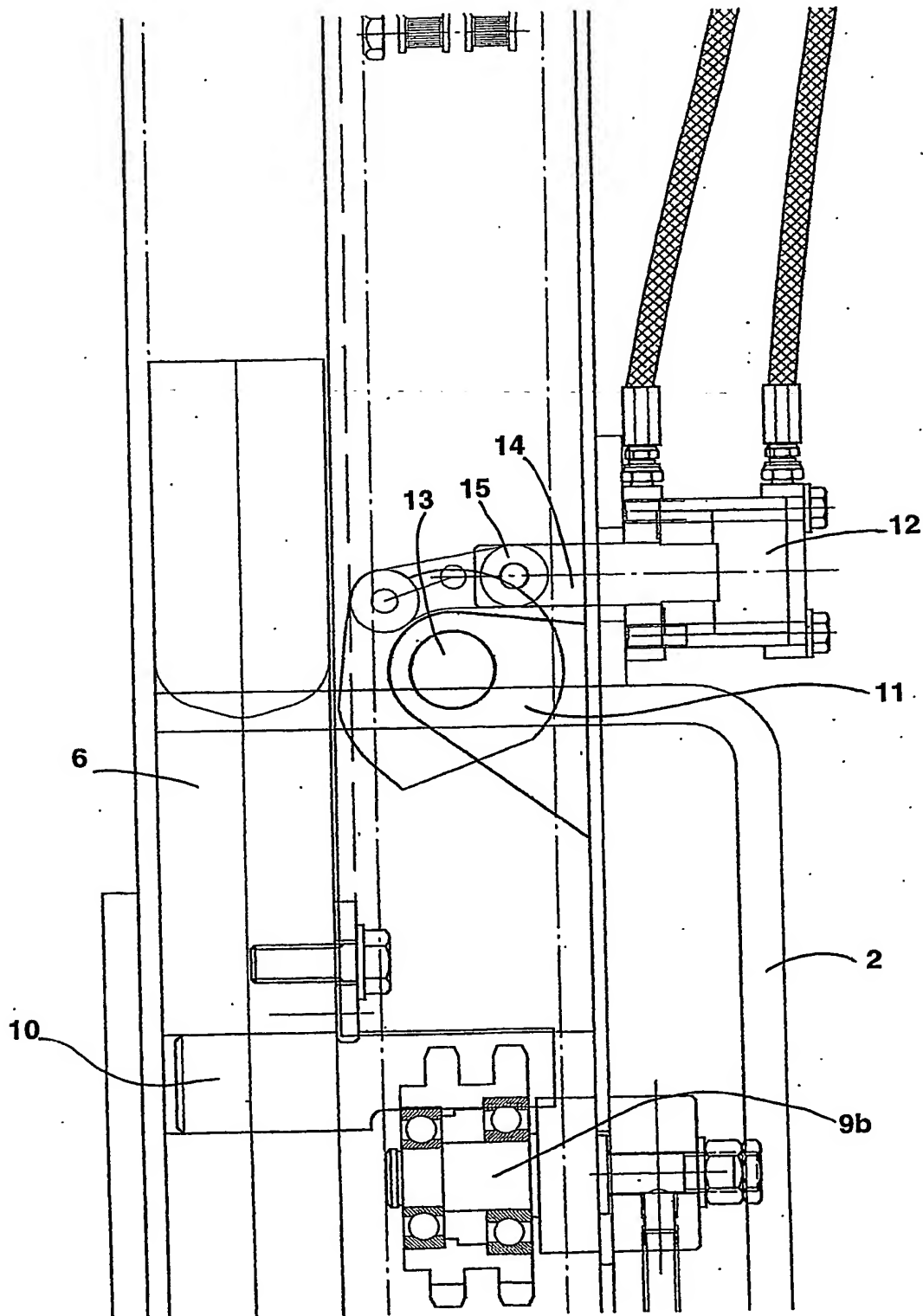


FIGURE 3

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